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PROLONGING THE LIFE OF MINE TIMBERS.

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PROLONGING THE LIFE OF MINE TIMBERS.

THE STUDY.

In the cost of mining and preparing anthracite, timber is a large factor. In 1905 for every ton of coal mined the timber used cost 8 cents, while the annual timber consumption for the whole anthracite region represented the cutting of approximately 150,000 acres of forest. Mine operators know that the rapidly increasing price and the decreasing supply of timber demand that every stick used either outside or inside the mines should be so handled as to give the greatest possible service.

In 1906 the Forest Service, in cooperation with the Philadelphia and Reading Coal and Iron Company, planned and carried on a series of experiments to determine the best methods of prolonging the life of mine timber. The results of the study are contained in this circular.

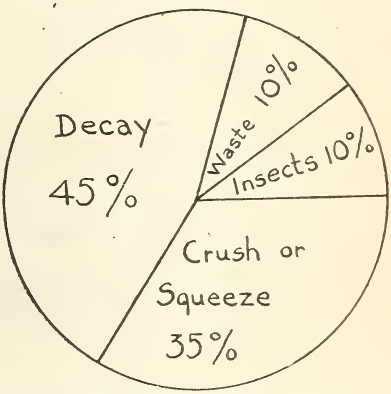

FIG. 1.—Diagram showing relative importance of the causes of destruction of mine timbers.

FACTORS DESTRUCTIVE TO ANTHRACITE MINE TIMBER.

Forty-five per cent of mine timber is destroyed by decay, while breakage, wear, and insects together destroy the remainder. (See fig. 1.) It is decay and its prevention in which the Forest Service is more especially interested. By direct experiment it is being shown that both oils and chemical salts, and the precaution of peeling and seasoning, prolong the life of the timber. The point of first practical importance, then, is: What method of handling and what preservative treatment will give the greatest service at the least expense?

DECAY.

Decay or rot is produced solely by certain organisms called bacteria and fungi. The species of fungi most destructive to mine timbers are *Fomes annosus* and *Polystictus versicolor*, of which the former is confined almost exclusively to the pines, and the latter is common in red and black oaks.

Germs or spores which produce decay may gain access to the timber at any time before or after it is cut, though for the most part the disease is contracted in the mines from decaying timber near by. In untreated timber, rough surfaces of bark and wood furnish a foothold for the spores, which subsequently germinate and attack the wood tissues. Spores may also enter timber only superficially treated through checks, cracks, or nail wounds.

For a fungus to exist it must have a definite amount of air and water, food, and heat. If mining conditions were such that the timber would be kept always wet or always dry, it would never decay. It is the alternating wet and dry conditions or continuous dampness which produce rot.

Ventilation is a very large factor in the life of mine timber. Poorly ventilated gangways and air passages, with a fair degree of moisture and a fairly high temperature, are favorable to fungous growth, and hence to rapid decay.

It is probably impossible to exterminate disease and so wholly to prevent decay in mine timber. Right preservative treatment, together with careful handling of the timber, will, however, reduce both to a minimum.

BREAKAGE.

A large percentage of the gangway timber used in anthracite mines is broken by the "squeeze" and "crush" of coal and rock. Where timber is certain to be broken in a few days or weeks, expensive preservative treatment would not be economical. However, in many situations the timber is broken only after it has been greatly weakened by decay, and for these cases an inexpensive form of treatment may very properly be considered.

WEAR.

Cross-ties in main haulage ways are constantly worn by the rails and by the feet of mules. Wooden rollers, drum laggings, etc., have to be replaced when worn by the constant contact of ropes and cables. A preservative treatment is obviously not suitable for timber subjected to this sort of wear.

INSECTS.

The important part which insects play in the destruction of mine timbers is rarely realized. They are foi the most part brought into the mines with the timber. Regular and thorough inspection and the rigid condemnation of insect-infested timber would therefore greatly reduce the loss from this source.

Insects bore into sound wood and greatly weaken it and, moreover, leave holes or galleries which encourage the entrance of wood-destroying fungi. A good preservative treatment will protect the timber from insect attack, as well as prevent decay. If the bark is removed from timber soon after it is cut, it will not be attacked by wood-boring insects until the wood becomes old and dry, after which it may be attacked by "powder post" and other borers.

WASTE.

In the handling of timber for its many uses in the mines there is some unnecessary waste. Though decay or a fracture is often confined to but one part of a set, the entire set is rendered useless. Therefore if it is possible to preserve the threatened part, the whole prop or set may be saved. Again, in certain situations the sizes of mine timbers may often be materially reduced provided they are kept sound. Under present conditions the timber is often large enough to do its work after decay has progressed to a considerable depth. Instead of offsetting this decay with sizes larger than necessary, smaller treated timbers may be used with economy.

The utilization of waste mining timber has been carefully investigated. Short sections of broken and partially decayed round timber have been split into laggings with some success. Worn-out and broken planks, sills, rollers, etc., have been profitably disposed of to railroad companies as fuel wood for locomotives with the additional benefit of cleaning up around the collieries. Worn-out drum laggings and short ends of sound gangway timber, formerly regarded as useless, have been sawed into short mine plank, car lumber, pulley bearers, and slab plank. Rough slabs from the mills have been split into laggings and the refuse of the mill consumed as fuel.

THE EXPERIMENTS.

PLAN OF EXPERIMENT.

Sets of round gangway timber averaging 13 inches in diameter were chosen as a basis for the experimental treating work. These sets, which are used for supporting the main haulage ways, consist of two legs (commonly 9 and 10 feet long) and a collar (from 6 to 7 feet long). They are usually placed in gangways at intervals of 5 feet through miles of passages. Each set represents about 26 cubic feet of timber, and one gangway frequently contains 1,000 sets. Ten gangways to a colliery is not an unusual number; and since the average life of the timber in these gangways is hardly above two years, the consumption of timber in anthracite operations is vast. (Fig. 2.)

It was early realized by the Forest Service that a successful preservative treatment would effect great saving in the use of this gangway timber, and the chief object of the experimental work was to learn to what extent gangway timber would be benefited by peeling, by seasoning or drying out, and by treating with a wood preservative. The comparative value of different kinds of wood for gangway timber was also considered. Pennsylvania pitch pine (*Pinus rigida*) and Southern loblolly pine (*Pinus tæda*) were the principal experimental timbers, since these species furnished the bulk of the round timber used in the mines of the company. Red oak (*Quercus rubra*) and chestnut (*Castanea dentata*) were tested as species suitable for planting in the anthracite region of Pennsylvania.

PEELING THE TIMBER.

Experiments have shown that peeled timber is superior in durability to unpeeled timber. The space between the bark and the wood especially favors the development of wood-destroying fungi and is a breeding place for many forms of insect life. When, after placement in the mines, the bark begins to flake off, the timber has already begun to decay. The cost of peeling timber before it goes into the mine ranges from 20 cents to 50 cents per ton of wood, according to local conditions and the kind of timber.

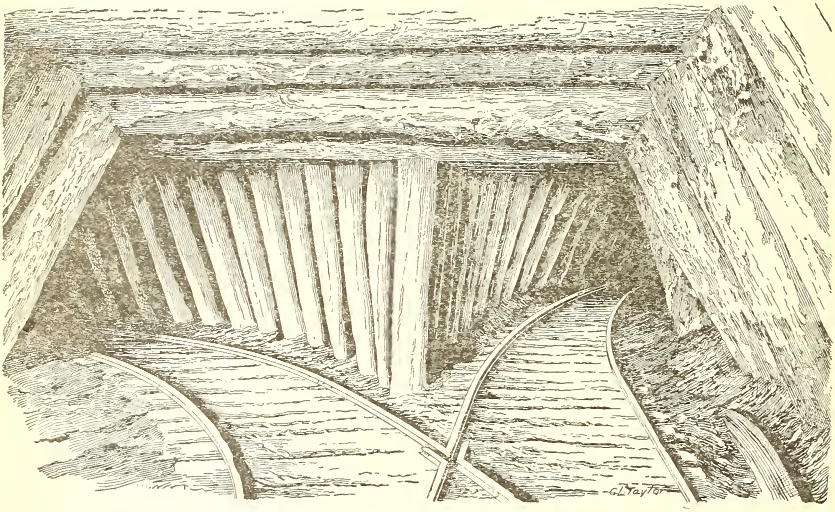

FIG. 2.—View in a Pennsylvania coal mine, showing the great amount of timber that is used. (Drawn from a photograph.)

SEASONING THE TIMBER.

Seasoning or drying gives mining timber greater strength and durability. A stick of wet timber has only about one-half the strength of a similar stick absolutely dry. Though it is not practicable for mining companies to hold their timber until it is absolutely air dry, peeled timber will dry out sufficiently in a few months to gain in both strength and durability. From two to four months is necessary for proper seasoning.

To learn the possible loss in weight in round gangway timber, due to peeling and seasoning, a test was conducted at one of the collieries of the company. Representative sticks of Southern loblolly pine, averaging from 11 to 13 inches in diameter and from 9 to 10 feet in length, were chosen. This timber was weighed immediately before and after peeling, to determine the weight of the bark. It was then weighed every two weeks until seasoned, to learn the weight of the water evaporated. The time of the year greatly favored rapid seasoning. The short lengths into which the timber was sawed gave a large drying surface in proportion to volume, and longer sticks would season more slowly. (Fig. 3.) Table 1 gives a synopsis of this test.

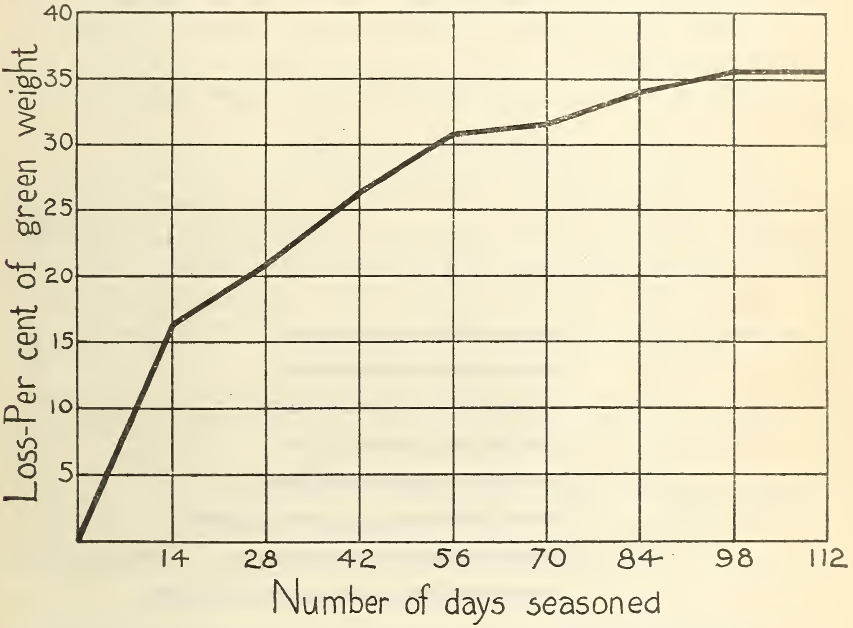

FIG. 3.--Diagram showing percentage of loss of green weight by seasoning.

TABLE 1.—*Peeling and seasoning test, Southern loblolly pine round timber, April 17 to July 24, 1906.*

	Per cent.
Total loss of green weight by peeling	8.1
Total loss of green weight by seasoning	35.1
Peeling and seasoning	43.2

RATE OF SEASONING.

Number of days seasoned.	Percentage of green weight lost.	Number of days seasoned.	Percentage of green weight lost.
14	16.2	70	31.4
28	20.5	84	33.7
42	26.2	98	35.1
50	30.3		

If a mining company handles its own timber from the woods to the mines, the saving in freight made possible by peeling and seasoning can readily be estimated. Labor is the principal factor in the cost of peeling, while the cost of seasoning must be represented by the loss of interest on the capital invested in the timber during the seasoning period. However, these additional items of expense are more than offset by a maximum reduction in freight of from 30 to 40 per cent and by the far better condition of the timber with regard to both its life at the mines and the readiness with which it will take preservative treatment. The peeling of timber at the mines has been unsatisfactory and expensive, because of the limited amount of yard room and the accumulation of bark. The following considerations favor peeling in the woods: (1) The saving in the cost of freight due to peeling and seasoning; (2) the saving of yard room at the mines; and (3) the prevention of fungous disease and insect attack by early peeling.

TREATING THE TIMBER.

Peeling and seasoning mine timber unquestionably increase its durability. However, in order to prolong its life to the fullest extent, a preservative treatment is necessary. (Fig. 4.)

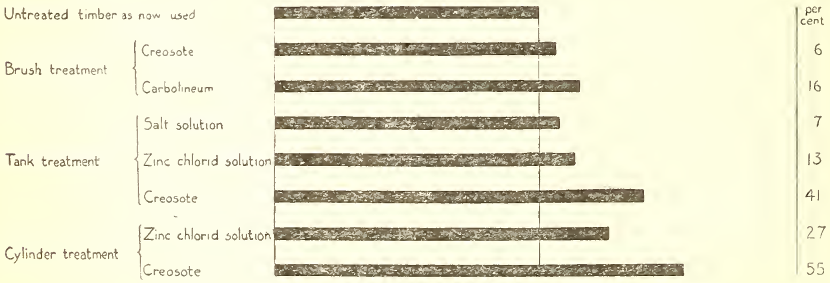

FIG. 4.—Increased life necessary to pay the cost of preservative treatments; shown by length of horizontal lines as compared with the first, which represents life of untreated timber.

Impregnated wood resists decay because the preservative is antiseptic and excludes the moisture necessary for fungus growth. Timber used in the mines was treated with a variety of preservatives under several methods of application. Both green and seasoned timbers were treated to determine both the relative value of the treatments and the best method of handling preparatory to treatment. If treated at all, the timber must be peeled. Table 2 shows: (1) The method of treatment; (2) the preservative applied; (3) the cost of the preservative; (4) the cost of the treatment, both for an average set of gangway timber and per cubic foot.

TABLE 2.—*Method and cost of treatment of mine props.*

Method of treatment.	Preservative applied.	Cost of preservative.	Cost of treatment.		Absorption per cubic foot
			Per set of gangway timber (25.8 cubic feet).	Per cubic foot.	
					Pounds.
Brush	Creosote (dead oil of coal tar).	$0.09 per gallon	$0.40	$0.015	....
	Carbolineum	.70 per gallon	1.15	.045	....
Open tank without pressure.	Salt solution, magnesium chlorid, 15 per cent.	.01 per pound	.50	.02	....
	Zinc chlorid solution, 6 per cent.	.04 per pound	.90	.035	....
	Creosote	.09 per gallon	2.85	.11	10
Cylinder with pressure.	Zinc chlorid solution, 6 per cent.	.04 per pound	1.90	.075	....
	Creosote	.09 per gallon	3.85	.15	10

BRUSH TREATMENTS.

Brush treatments with both creosote and carbolineum were applied in two coats to the Pennsylvania and Southern pines. A large flat brush and a kettle of the hot preservative are all that is required for this treatment. A very small amount of the preserving fluid suffices, but the cost of application in proportion to the results obtained is considerable. For small individual operators who can not afford the cost of a large plant, brush treatments are feasible and economical.

The disadvantages of brush treatments are:

(1) The difficulty of completely covering the timber and filling all checks and cracks.

(2) The very slight penetration secured. The subsequent checking or opening of the timber may often allow disease to pass through the shallow exterior band into the untreated interior wood.

OPEN-TANK TREATMENTS.

Pitch pine and loblolly pine have been most successfully treated with both creosote (dead oil of coal tar) and a 6 per cent solution of zinc chlorid by the open-tank process.

DESCRIPTION OF TANK.

The experimental open tank was, for the most part, constructed from old material already in the possession of the company. A section of an old boiler 34 inches in diameter and 13 feet in length was set vertically in the ground to a depth of 5 feet. This tank had a double bottom, separated by a space of 1 foot. Between the two bottoms a coil of 1-inch pipe 20 feet in length carrying a steam pressure of 110 pounds per square inch furnished the heating surface necessary to give the preservative fluid a maximum temperature of 240° F. This coil was connected by a 1-inch pipe to a 10-inch steam main 75 feet distant. The timbers, which were placed vertically in the tank, were immersed by attaching a circular weight to their lower ends. The timbers were lowered into and hoisted from the tank by means of a small hand derrick with a swinging arm.

DESCRIPTION OF THE TREATMENT.

The open-tank treatment as given in this experiment was briefly as follows: Green, partially seasoned, and thoroughly seasoned timber was lowered into the tank and immersed in creosote, or in a zinc chlorid or salt solution, at a temperature of from 90° to 120° F. The temperature of the creosote was raised by the coils to from 212° to 220° F., and that of the zinc chlorid or the salt solution to about 212° F. In no case, however, was the temperature allowed to go above 240° F. for fear of injuring the fiber of the timber and so decreasing its strength. When this hot bath was over the steam was turned off, and the timber was allowed to stand until the liquid cooled to a temperature of from 170° to 100° F. The periods of heat and of cooling were varied for each kind of timber and for each stage of its seasoning. The time required for the cooling operation, which depended largely upon the temperature of the atmosphere, was usually from three to twelve hours. For the whole treatment the time varied from six to twenty hours.

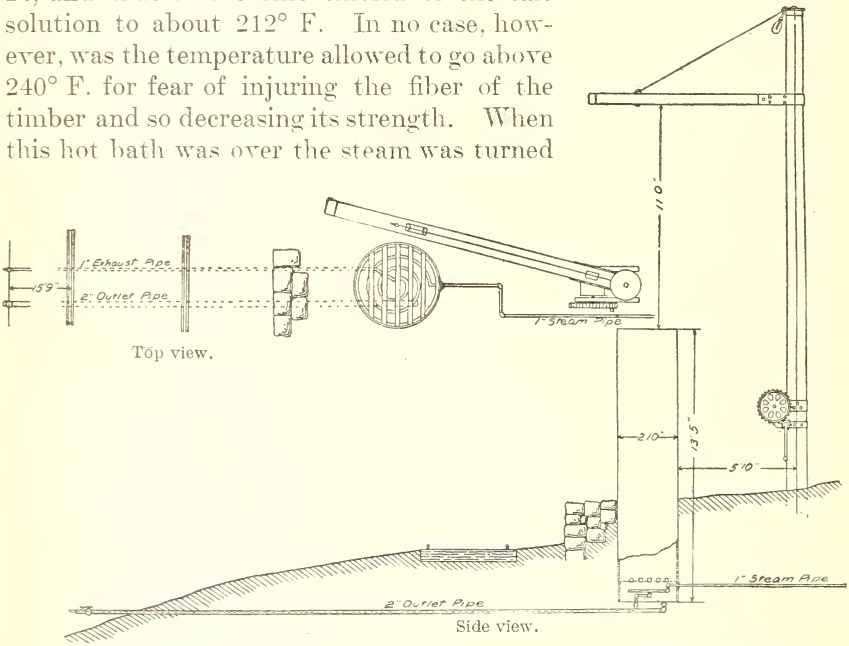

Fig. 5.—Diagram of an experimental tank used for treating mine timbers.

THEORY OF THE OPEN-TANK PROCESS.

The theory of the open-tank process may be given in a few words. The heat of the preservative expands and expels a portion of the air and water contained in the cellular and intercellular spaces of the wood tissue, and as the preservative cools there is a contraction and condensation of the air and water which remain. To destroy the partial vacuum thus formed, the liquid is forced by atmospheric pressure into the cellular and intercellular spaces, a process aided, of course, by capillary attraction. In point of fact, therefore, the hot bath merely prepares the wood for absorbing the preservative, and the actual impregnation follows as the preservative cools.

The ease and effectiveness with which timber can be treated by this process depend upon the kind of wood and its degree of dryness. In one species the structure of the wood tissues may effectually resist and in another may greatly favor the expulsion of air and water during the hot bath; in seasoned timber air, and in green timber water, is the chief element to be removed before the wood can be impregnated, and since air may be expelled much more easily than water, seasoned timber is the more successfully treated.

POSSIBILITIES AND REGULATIONS OF THE TREATMENT.

Loblolly and pitch pine, among the more important mining timbers of the anthracite region, have been treated by the open-tank process with particular success. By simply immersing the timber first in hot and then in cold preservative fluids a penetration of from 1 inch in green timber to from 4 to 5 inches in seasoned timber has easily been secured. Aqueous solutions of zinc chlorid and common salt have been absorbed with as much ease as creosote.

In timbers which have a considerable proportion of heartwood the line of demarcation separating heartwood and sapwood is frequently also the line separating the treated and the untreated wood. In past experiments with the open-tank process the heartwood has not been penetrated to a great depth, though this may be accomplished hereafter. The sapwood of chestnut and red oak has been treated with a fair degree of success, but with extremely little penetration of the heartwood.

With absolutely green timber it has been a question of obtaining the greatest possible impregnation in the entire period of treatment (twenty hours). For green timber the period of heat or preparation for treatment has been increased from its usual length (seven hours) to eighteen hours, and this timber has been given two separate entire treatments on successive days without any improvement over the standard treatment of twenty hours.

The treatment of loblolly and pitch pine is regulated by the proportion of heartwood and sapwood contained and the degree of seasoning reached. With a stick of pine absorption is more easily controlled by varying the duration of the cold bath than by varying that of the hot bath. The duration of the hot bath necessary to prepare any form or kind of timber for impregnation is exceedingly variable. Seasoned timber, however, absorbs the cooling preservative with a fair degree of regularity down to a temperature of 120° F. (Fig. 6.)

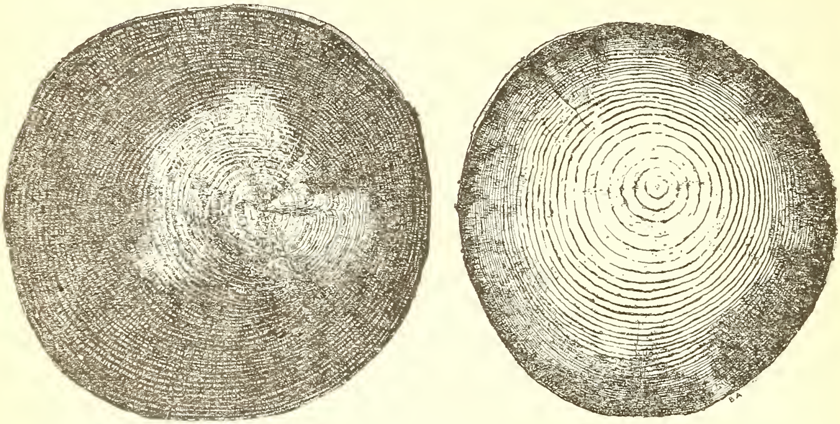

Fig. 6.—Comparative penetration in seasoned and green loblolly pine. Both sticks were given the same treatment. The seasoned piece has practically full penetration (Drawn from a photograph.)

Table 3 gives average and representative treatments of loblolly and pitch pine by the open-tank process:

Table 3.—*Average and representative treatments of loblolly and pitch pine by the open-tank process.*

CREOSOTE.

Average Absorption and Penetration, Loblolly Pine (Pinus Tæda.)

Condition of timber.	Absorption per cubic foot.	Depth of penetration.
	Pounds.	*Inches.*
Green	5-7	$\frac{3}{4}$-1$\frac{1}{2}$.
Seasoned (1 to 2 months)	12-15	2-4.
Seasoned (3 to 4 months)	20-25	5-Complete.

Representative Individual Runs, Seasoned Loblolly Pine (Nearly All Sapwood).

Time seasoned.	Total length of treatment.	Duration of hot bath.	Temperature.		Absorption per cubic foot.	Penetration.
			Average.	Maximum.		
Months.	*Hours.*	*Hours.*	° *F.*	° *F.*	*Pounds.*	*Inches.*
3	24	7	230	240	22.0	4-5
3	24	4$\frac{1}{2}$	225	235	21.5	4-5
3	6$\frac{1}{2}$	1$\frac{3}{4}$	178	220	10.7	2-3
3	6	2	173	210	10.7	2-3
3	4$\frac{1}{4}$	1$\frac{1}{2}$	174	198	10.2	2-3

TABLE 3.—*Average and representative treatment of loblolly and pitch pine by the open-tank process*—Continued.

REPRESENTATIVE INDIVIDUAL RUNS, SEASONED PITCH PINE (HEARTWOOD AND SAPWOOD).

Time seasoned.	Total length of treatment.	Duration of hot bath.	Temperature.		Absorption.	Penetration.	Width of sapwood.
			Average.	Maximum.			
Months.	*Hours.*	*Hours.*	*° F.*	*° F.*	*Lbs. per cu. ft.*	*Inches.*	*Inches.*
4	22	7½	215	240	5½	¾	¾
4	22	7½	218	240	12	1¾	1½
4	22	7¼	209	232	21½	3	2¾

SOLUTION OF ZINC CHLORID (6-8 PER CENT).

THOROUGHLY SEASONED LOBLOLLY PINE (NEARLY ALL SAPWOOD).

Total length of treatment.	Length of period in hot solution.	Temperature.		Absorption.	Penetration.
		Average.	Maximum.		
Hours.	*Hours.*	*° F.*	*° F.*	*Lbs. per cu. ft.*	*Inches.*
20	6	200	210	20	3-5
20	6	200	210	35	4-6

SUMMARY OF THE OPEN-TANK TREATMENT.

(*a*) Loblolly and pitch pine can be successfully and economically treated by simple immersion in successive hot and cold baths in an open tank, at a cost of about 11 cents per cubic foot.

(*b*) Green timber is treated with far more difficulty than seasoned timber.

(*c*) The difference in weight of green timber before and after treatment is by no means indicative of the amount of the preservative absorbed. The simple application of the hot liquid to green timber slightly reduces its weight and yields no penetration. The same application to seasoned timber slightly increases its weight and gives a slight penetration. Green timber after treatment may show a penetration of 1 inch without an increase in weight.

(*d*) Heartwood of both loblolly pine and pitch pine is penetrated with far more difficulty than is the sapwood of the same species. This is especially the case with pitch pine, which clearly shows after treatment a distinct division between the treated sapwood and the untreated heartwood.

(*e*) Experiments indicate that for pine timbers of the same degree of dryness or containing equal proportions of heartwood and sapwood impregnation can be regulated by increasing or decreasing the duration of the cooling bath.

Cylinder Treatment.

Loblolly pine gangway timber was treated for experimental purposes in a closed cylinder under pressure. One portion of this timber was treated with 12 pounds of creosote per cubic foot, and the remainder with a 5 or 6 per cent solution of zinc chlorid.

METHOD OF TREATMENT.

The timber to be treated was loaded on trucks and drawn into a 6-foot steel cylinder by means of a wire cable. The doors of the cylinder were closed, and steam was turned in at the required pressure for from four to six hours. When the steam had been allowed to escape and the condensed water in the cylinder to run off, a vacuum of 22 inches was applied. During this process steam was passed through the heating coils within the cylinder. The preservative fluid was then run into the cylinder and pressure was applied until the desired absorption was attained.

Comparative Cost of Open-Tank and Cylinder Treatments.

The method of treatment in a closed cylinder under pressure is effective but expensive. Here, as in the previous treatments, the cost of the preservative is a large item, but the cost of application is far greater by the cylinder process than by the others. The saving secured by the open-tank method is due to—

(1) The omission of the steam, vacuum, and pressure features of the cylinder process and the elimination of the expensive machinery necessary for those stages of the treatment.

(2) The light construction of the tank, allowed by the lack of strain on the walls.

(3) The small amount of labor required in the operation of an open-tank plant, due to the simplicity of its construction and method of applying the preservative.

(4) The fact that the cost of construction and maintenance of an open-tank plant is less than one-fifth that of a cylinder plant of equal capacity.

COMPARISON OF EXPERIMENTAL SETS OF GANGWAY TIMBER.

During the past year (1906-7) gangway timber of various species, peeled and unpeeled, green and seasoned, and treated and untreated, has been placed in gangways in the collieries of the company. (Fig. 7.) Each and every kind and condition of gangway timber has been compared with the timber in most general use in the southern anthracite region, namely, green, unpeeled loblolly, and pitch pines. The object of this comparison is to prove exactly to what extent the experi-

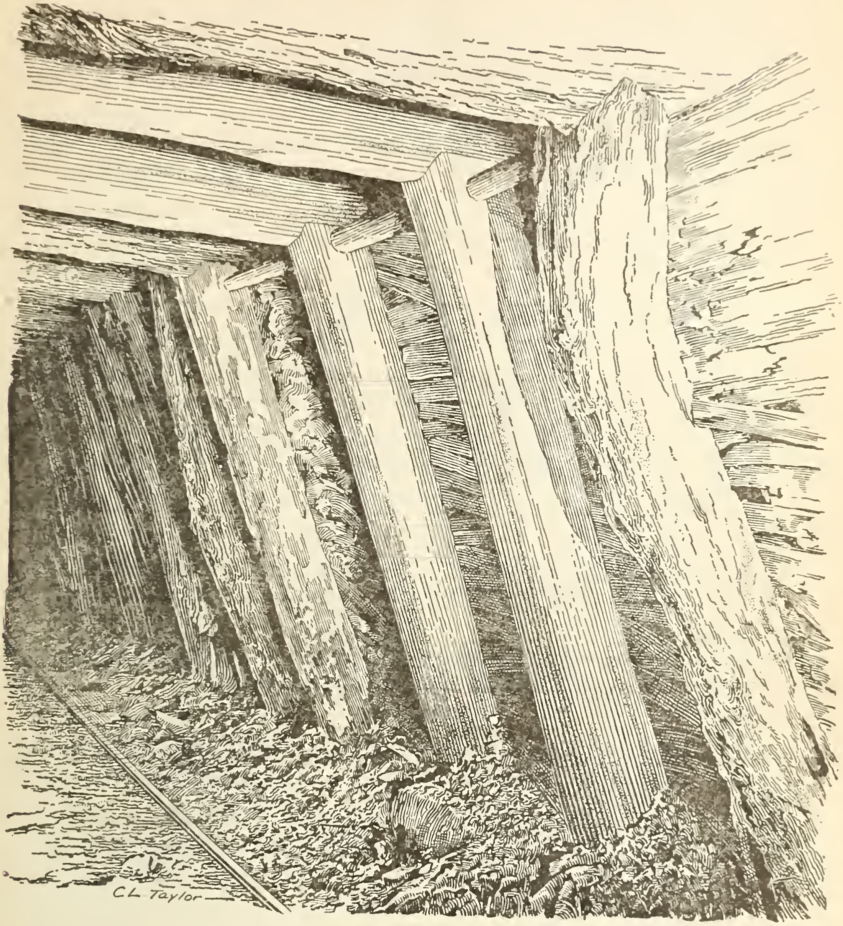

FIG. 7.—Partially seasoned loblolly pine gangway timbers after ten months' service. Treated with creosote by the open-tank process. (Drawn from a photograph.)

mental timber is superior to that at present used. In the course of the experimental work the following comparisons have been made:

Species compared.	Treatments compared.	
Loblolly pine (*Pinus tæda*). Pitch pine (*Pinus rigida*). Longleaf pine (*Pinus palustris*). Chestnut (*Castanea dentata*). Red oak (*Quercus rubra*).	Brush	Creosote. Carbolineum.
	Open-tank	Creosote. Solution of zinc chlorid. Solution of sodium chlorid and magnesium chlorid.
	Cylinder	Creosote. Solution of zinc chlorid.

KEEPING RECORDS.

The history of each set of gangway timber and each part of each set has been recorded in writing and on maps. These records include: (1) The date of setting; (2) the colliery; (3) the gangway; (4) the position in the gangway relative to the nearest chute and adjacent set of timber.

Table 4 gives a summary of the experimental sets of timber placed in the mines of the Philadelphia and Reading Coal and Iron Company in 1906.

TABLE 4.—*Summary of experimental sets of timbers.*

	Colliery.			Total.
	Silver Creek.	Eagle Hill.	Wadesville.	
Untreated:				
Seasoned peeled	11 loblolly	26 loblolly		37
Green peeled	44 loblolly 16 longleaf	16 loblolly 8 longleaf	14 pitch pine	98
Green unpeeled	112 loblolly 31 pitch pine 8 black oak 1 white oak	36 loblolly 7 pitch pine	26 pitch pine	221
Total untreated				356
Brush treatment:				
Green—				
Carbolineum	14 loblolly	9 loblolly	4 pitch pine	27
Creosote	18 loblolly 5 chestnut	9 loblolly	6 pitch pine	38
Seasoned—				
Carbolineum	7 loblolly	9 loblolly	6 pitch pine	22
Creosote	9 loblolly	28 loblolly	5 loblolly	42
Total brush treatment				129
Tank treatment:				
Green—creosote	104 loblolly 7 chestnut 5 pitch pine 2 black oak	6 loblolly		124
Seasoned—				
Creosote	20 loblolly 11 pitch pine			31
Salt			17 pitch pine 14 loblolly	31
Zinc chlorid	6 loblolly 5 longleaf			11
Total tank treatment				97
Cylinder treatment, seasoned:				
Creosote	23 loblolly			23
Zinc chlorid	50 loblolly			50
Total cylinder treatment				73
Grand total				755

RESULTS DERIVED FROM EXPERIMENTS.

Though results so far derived from actual experiments do not cover all classes of mine timber under all conditions, they show that it will unquestionably pay mining companies to peel their round timber, to season it for a few months, and to treat it thoroughly with some good preservative. For pitch pine and loblolly pine, the open-tank process with creosote has proved an efficient and economical method of treatment. The preservative value of zinc chlorid for mining purposes is yet to be determined. Gangway timbers treated with creosote by the cylinder process are standing well. Because of its cost, however, this form of treatment should not be considered unless, in comparison with the far less expensive open-tank method, it gives universally better results. Timbers treated by the brush method with creosote and carbolineum have so far effectively resisted decay. Because of the very simple method of application, brush treatment may prove advantageous for small consumers, or where the timber is in great danger of being broken by excessive crushes.

As a direct result of these cooperative experiments, the company is considering the advisability of treating their mine timber on a more extensive scale. Plans have been drawn up for the construction and erection of a commercial open-tank wood-preserving plant at one of its collieries. This plant will have a daily capacity of about thirty sets of gangway timber (800 cubic feet), and will be large enough to treat all timber at this colliery except that which is broken or worn out. Creosote or a solution of zinc chlorid, or both, will be the preservative fluids used, although the plant is designed for the use of any preservative which may prove efficient.

A TIMBER POLICY FOR THE SUCCESSFUL PRESERVATIVE TREATMENT OF MINE TIMBER.

If a mining company has proved by actual experiment that timber preservation is practical and economical, it should be in a position to carry it out. To do this timber can not be rushed directly from the woods to the mines; there must be time for preparing it for treatment and for treating it. This means the storage of a reserve supply of felled timber at one or more points.

To insure a regular supply of timber for their present and future needs mining companies should purchase and operate tracts of timberland. For such an investment to be permanent, the logging must be carefully and economically done, and the forest protected from fire and managed on sound principles. The timber should be peeled immediately upon being felled in the woods, and allowed to season while waiting on cars for shipment. In this way freight charges on bark and a portion of the water present in green wood will be saved and the timber will be rendered more resistant to decay. In many cases the time consumed before and during transportation may be enough to season the timber sufficiently to prepare it for preservative treatment on its arrival at the mines.

A careful and thorough inspection of all timber is strongly recommended. It would be poor economy to apply expensive preservative treatments to defective material. Timber cut from land owned by the mining company should be inspected in the woods or at the point of shipment, to avoid unnecessary freight charges. Timber shipped to the mines by outside parties should be just as carefully inspected. At present, timber is sometimes accepted in such condition that it is doubtful whether its service in the mines would pay for the cost of setting it, exclusive of the cost of the timber. No matter how critical the timber situation may be, it is believed that the policy of accepting everything is a poor one.

More supervision in the setting of mine timber is suggested. A contract system of timbering without proper supervision means setting the greatest amount of timber in the shortest possible time, regardless of where and how the timber is placed. If timber is so placed that it can not properly resist the strains to which it is subjected, and its strength is not utilized, it represents a partial or total loss. If it will pay to treat timber with preservatives in order to resist decay, it will surely pay to handle it right to resist the allied factors of destruction.

It should be borne in mind that the results derived from these experiments are especially applicable to the Pennsylvania and Southern pines used in the anthracite mines of the Schuylkill region. For other forms of mining and in other regions it will be necessary to conduct other experiments to meet local requirements.

Results obtained by actual experiment clearly prove that it will pay mining companies to peel their timber, to season it for several months, and to treat it with a good wood preservative. Loblolly and pitch pine have been most successfully preserved by a treatment with creosote in an open tank. This method of treatment is simple and economical. As a direct result of the experimental work the company is considering the advisability of taking up wood-preserving work on a more extensive basis, and has drawn up plans for the erection of an open-tank wood-preserving plant at one of its collieries.

In order to apply a preservative treatment successfully, a mining company must be able to regulate its timber supply. To regulate this timber supply and to make adequate provisions for the future, it is advisable that mining companies own and operate tracts of timberland. By peeling and seasoning timber where it is cut a reduction in freight charges of 30 to 40 per cent is possible.

The necessary waste timber about the mines can be utilized and the unnecessary waste largely prevented.

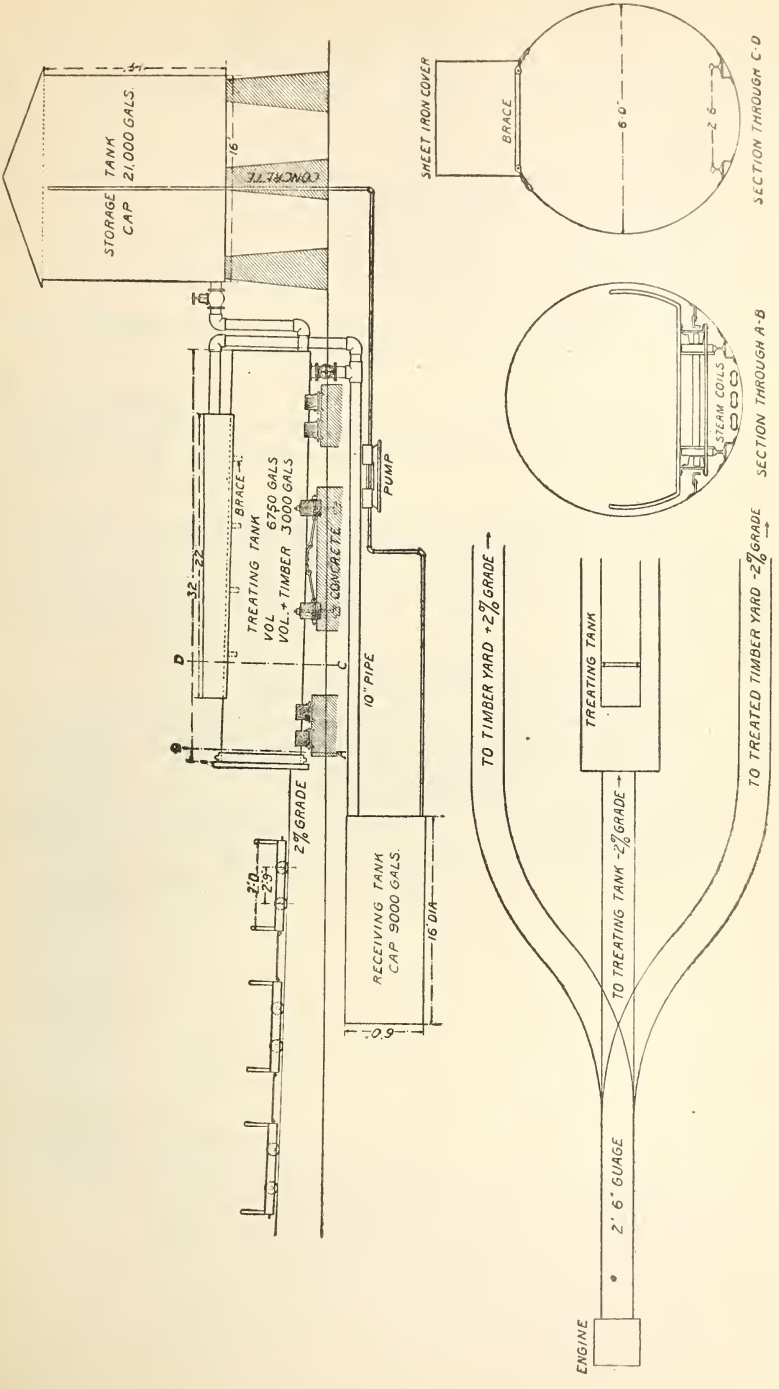

FIG. 8.—Diagram of a small commercial plant for treating mine timbers, cross-ties, cross-arms, etc.

A strict and efficient system of inspection for all timber and more care in setting mine timber would result in a considerable economy.

The results obtained from these experiments are more especially applicable to the southern anthracite region of Pennsylvania.

Approved:

W. M. Hays,
Acting Secretary of Agriculture.

Washington, D. C., *August 12, 1907.*

OTHER PUBLICATIONS OF THE FOREST SERVICE WHICH DEAL WITH WOOD PRESERVATION.

Bulletin 10. Timber: An Elementary Discussion of the Characteristics and Properties of Wood. (Securable only by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.)

Bulletin 41. Seasoning of Timber.

Bulletin 50. Cross-Tie Forms and Rail Fastenings, with Special Reference to Treated Timbers. (Securable only by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.)

Bulletin 51. Report on the Condition of Treated Timbers Laid in Texas, February, 1902.

Circular 39. Experiments on the Strength of Treated Timber.

Circular 80. Fractional Distillation of Coal-Tar Creosote.

Circular 98. Quantity and Character of Creosote in Well-Preserved Timbers.

Circular 101. The Open-Tank Method for the Treatment of Timber.

Circular 103. Seasoning of Telephone and Telegraph Poles.

Circular 104. Brush and Tank Pole Treatments.

Extract 395 from the Yearbook of the Department of Agriculture (1905): Prolonging the Life of Telephone Poles.

[Cir. 111]

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